

Tod, I.C. 1989. Irrigation and drainage of heavy clay soil. Ph.D. Dissertation. University of California, Davis. 234pp.

Many irrigation projects in arid and semi-arid climates are located on stratified alluvial soils having substantial areas of cracking clay soils. Cracking soils have distinctive hydraulic properties resulting from the cracks that form in the soil when drying. Irrigation and drainage management of these soils is greatly influenced by the extent of cracking within the soil. Field studies were undertaken to examine water and salt movement through the soil profile to subsurface drains on border checks of clay soils in Imperial Valley, California. Irrigation water was found to infiltrate into the soil primarily through cracks which filled rapidly near the irrigation wetting front. The wetting front advance rate was constant indicating that a uniform depth of water infiltrates along the border. Water penetrated to all depths within the profile soon after the passing of the wetting front. Flow in subsurface field drains increased soon after the start of irrigation due mainly to flow down the backfilled drainline trench. The drains intercepted only a small percentage of deep percolation water. Peak flow occurred soon after irrigation had stopped and within about 40 hours thereafter, drain flow returned to the magnitude of pre-irrigation flow. The salinity of the drain water remained nearly constant throughout the year. A numerical model was developed to analyze flow to subsurface drains in clay soils close to an artesian aquifer based on field observations of the hydrologic setting of the clay field in Imperial Valley. The model was calibrated with field data and model results were used to develop empirical equations to calculate the contribution from different sources to the drain flow. An analysis of drain performance and the efficiency of drains in removing deep percolation water indicate that field surveys conducted as part of the design process should be sufficient to ensure that the different possible sources of water contributing to drain flows are identified and estimated.